



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

- COURSE NAME : NETWORK FLOW
- COURSE CODE : BWA 31003
- PROGRAMME CODE : BWA
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

TERBUKA

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Q1 A textile company produces two types of material *A* and *B*. Material *A* is produced according to direct orders from furniture manufacturers. The material *B* is distributed to retail fabric stores. The average production rates for material *A* and *B* are identical at 1000 metres per hour. By running two shifts the operational capacity of the plant is 80 hours per week. The marketing department reports that the maximum estimated sales for the following week is 70,000 metres of material *A* and 45,000 metres of material *B*. According to the accounting department the profit from a metre of material *A* is RM2.50 and from a metre of material *B* is RM1.50. The management of the company decides that a stable employment level is the primary goal for the firm. Therefore, whenever there is demand exceeding normal production capacity, the management simply expands production capacity by providing overtime. However, the management feels that overtime operation of the plant of more than 10 hours per week should be avoided because of the accelerating costs. The management has the following goals in the order of importance:

- P_1 : Avoid any under-utilization of production capacity.
- P_2 : Limit the overtime operation of the plant to 10 hours.
- P_3 : Achieve the sales goals of 70,000 and 45,000 respectively for both the materials.
- P_4 : Minimize the overtime operation of the plant as much as possible.

Formulate the problem as a goal programming model to help the management for making the best decision. Do not solve the model.

(10 marks)

Q2 Consider the following pre-emptive goal programming model.

$$\text{Minimize } P_1d_1^+ + P_2d_2^+ + P_3d_3^- + P_4(3d_4^- + d_5^-)$$

subject to

$$\begin{aligned} x_1 + 2x_2 - d_1^+ + d_1^- &= 40 \\ 4x_1 + 3x_2 - d_2^+ + d_2^- &= 120 \\ 40x_1 + 50x_2 - d_3^+ + d_3^- &= 1,600 \\ x_1 - d_4^+ + d_4^- &= 30 \\ x_2 - d_5^+ + d_5^- &= 20 \\ x_1, x_2, d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+, d_4^-, d_4^+, d_5^-, d_5^+ &\geq 0 \end{aligned}$$

(a) Use the graphical goal programming procedure to solve the problem. (15 marks)

(b) If the first and third priority levels are interchanged, what would be the new solution? (5 marks)

Q3 A human resource department in Company Z is allocating five representatives to three locations to do marketing. A maximum of four representatives may be allocated to any one location. **Table Q3.1** provides the sales revenue where each location as a function of the number of sales representatives. The estimates of the likely sales revenue are in RM1,000. The company’s main objective is to maximize the sales revenue.

Table Q3.1

Location	Number of sales representative				
	0	1	2	3	4
<i>P</i>	55	53	76	34	53
<i>Q</i>	65	42	35	55	66
<i>R</i>	49	66	44	79	33

Determine the optimal allocation of representatives to locations and the maximal total sales revenue.

(15 marks)

Q4 A manufacturer company uses material *X* as the basic material for the production of product *X*. The ordering cost, holding cost per unit and the demand forecast of material *X* for the next 3 months by the management are given in **Table Q4.1**.

Table Q4.1

Month, <i>i</i>	Demand, <i>D_i</i>	Ordering Cost, <i>K_i</i> (RM)	Holding Cost, <i>h_i</i> (RM)
1	5	5	1
2	2	7	1
3	3	9	1

The basic material is bought at the beginning of each month. The unit purchase cost is RM1 for the first 6 units and RM2 for additional units. The company wants to find an ordering policy for the next 3 months so as to minimize the total cost if the initial stock is 2 units and the final stock is required to be zero.

Solve the problem using Dynamic Programming, and hence advise the company to make its optimal policy for the next three months.

(15 marks)

Q5 The cost of delivery of a unit of production (in RM) from the supplier to the consumer is located at the lower right corner of the cell in **Table Q5.1**.

Table Q5.1

Supplier	Consumer			Supply
	<i>A</i>	<i>B</i>	<i>C</i>	
<i>X</i>	2	5	9	300
<i>Y</i>	7	3	6	200
<i>Z</i>	4	8	3	200
Demand	200	400	100	

It is necessary to construct a transport plan in which the total cost of delivery will be the lowest. By using the Least Cost Method, find the initial feasible solution. Hence, use an appropriate method to determine the optimal solution.

(20 marks)

- END OF QUESTIONS -